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**A REVIEW OF THE STATUS AND APPROXIMATE RANGE  
OF SUMATRAN RHINO POPULATION IN SG. DUSUN GAME  
RESERVE AND SURROUNDING AREAS**

**KAJIAN MENGENAI STATUS DAN ANGGARAN  
KAWASAN KELIARAN POPULASI BADAQ SUMATRA  
DI REZAB HIDUPAN LIAR SG. DUSUN DAN  
KAWASAN SEKELILINGNYA**

**By:**

**Mohd Zuber bin Mohd. Zain**

**ABSTRACT**

This paper is essentially a review of the earlier findings by D.L. Strickland with respect to the status and home-range of the Sumatran rhinos in Sg. Dusun Game Reserve and the surrounding areas. This study reveals that the ranges described earlier is essentially a part of movement within the core area; an area that span between the northern and the North-western half of the reserve, towards Sg. Bernam. During the course of study we found abundant rhino signs on both sides of Bernam river from the DID headworks to the point where Sg. Dusun joined Sg. Bernam. Signs were also found South of Felda Besaot 4 and therefore the core area defined earlier should also include this recent findings. Total excursion range of the Sumatran rhinos should include a movement typical of this animal but irregular referred as 'wandering'. A factor yet undetermined prompted the individual to abandon the usual pattern of movement within the core area and embarked on a far ranging journey This was observed last year.

A rhino survey was undertaken to determine the status of the population. From the results obtained it was deduced that the minimum population consist of five animals. A pair believed to be a mother and a semi-independent calf were found within the reserve and this reproduction indicated that the population is viable.

A project to increase food supply was initiated. It was observed that Bertam which was extensive here had a suppressive effect on the regenerations of plants which form the major supply of rhino food. Cutting of Bertam increased regenerations and it was observed that rhino began visiting this area. .

In those areas where food is scarce planting of rhino food plants is recommended. It is hoped that the increase in food supply will increase carrying capacity and will confine the rhinos in a smaller area in the reserve thus encouraging mating.

Conservation measures taken were mentioned and several conservation proposals were highlighted. Dangers threatening the population were discussed and possible solutions forwarded. The population has a good future. It will definitely survive and multiply as the Javan rhinos in Udjong Kulon if serious conservation effort is implemented.

## ABSTREK

Kertas ini merupakan ulasan berkenaan dengan penyelidikan yang dilakukan oleh D.L. Strickland ke atas status dan kawasan keliaran Badak Sumatra di Rezab Sg. Dusun dan di kawasan yang berhampiran. Kajian ini menunjukkan bahawa kawasan keliaran yang terdahulu merupakan sebahagian daripada pergerakan di dalam pusat kawasan iaitu kawasan di antara utara dan sebahagian daripada barat daya rezab ke arah Sg. Bernam. Semasa kajian ini dijalankan, banyak terdapat kesan-kesan badak di kedua-dua belah Sg. Bernam iaitu daripada permulaan kerja JPT ke tempat pertemuan Sg. Dusun dan Sg. Bernam. Kesan-kesan juga terdapat di selatan Felda Besout 4 dan dengan itu kawasan pusat yang terdahulu mesti juga memasukkan pertemuan yang baharu ini. Ke-luasan kawasan keliaran Badak Sumatra patut termasuk pergerakan biasa binatang ini yang tidak menentu yang dianggap sebagai merayau. Satu faktor yang tidak diketahui telah menyebabkan individu ini meninggalkan corak perjalanan yang sama dalam kawasan pusat dan memulakan keliaran yang jauh. Ini diperhatikan pada tahun lepas.

Satu bancian badak telah dijalankan untuk menentukan status populasinya. Daripada keputusan yang diperolehi adalah dianggap bahawa populasi minima terdiri dari lima individu. Sepasang badak, dipercayai ibu dan anak telah di-jumpai di dalam rezab dan pembiakan ini menunjukkan bahawa populasi ini adalah subur.

Projek untuk menambah bekalan makanan telah dimulakan. Adalah diperhatikan bahawa pokok Bertam yang banyak kedapatan di sini menahan pertumbuhan pokok-pokok yang menjadi makanan utama badak. Badak-badak ini mula mengunjungi kawasan ini setelah pokok-pokok bertam itu dipotong.

Adalah dicadangkan agar pokok-pokok yang menjadi makanan badak ditanam di kawasan-kawasan yang kurang terdapat makanan. Dengan ini diharapkan dengan bertambahnya makanan, had muatan sesuatu tempat itu juga akan bertambah dan membolehkan badak-badak itu tinggal di kawasan yang kecil di rezab tersebut. Jika ini berlaku pembiakan akan menjadi lebih mudah.

Langkah-langkah konservasi yang diambil disebutkan serta beberapa cadangan-cadangan konservasi. Bahaya yang mengancam populasi ini dan langkah-langkah mengatasinya juga dibincangkan. Populasi ini mempunyai masa depan yang cerah kerana jika usaha-usaha konservasi yang serious diambil, ianya akan terus hidup dan berganda seperti Badak Jawa di Udjong Kulon.

## **1. BACKGROUND**

The Sg. Dusun Game Reserve was established in June 1964 based on recommendations put forward by the then Game Department to the Selangor State Government. The main purpose was to provide a habitat protected by the law to the last remaining population of Sumatran rhino in the State. The recommendations were based on a study by O.B. Milton entitled 'Field notes on wildlife conservation in Malaya' in which he pointed out that the surviving rhinos will definitely be perished if a sanctuary is not provided immediately as most of the forest nearby is either being cleared for Felda schemes or being leased out for logging. Although the approved area was much smaller than the proposed plan it was an important milestone in rhino conservation in this region as it is one of the earliest reserves specifically established for the rhino. Although the reserve constitutes only a part of the total core area traditionally used by the rhinos, it still covered a series of important wallows and saltlicks.

Two years later in 1966 another researcher D.L. Strickland came to the area to make a more intensive study of the rhinos and their habitat. In his report 'Ecology of the rhinoceros in Malaya', he managed to define approximate ranges of three rhinos using the northern half of the reserve and areas adjacent to it (Map 2).

He forwarded several recommendations for the conservation of the species and these include.

- a. a ranger's post should be established within the reserve and regular patrolling done within the reserve and surrounding areas.
- b. requesting adjacent land on the western side of the reserve as it is within the core which is heavily used by the population.
- c. to manage the reserve in order to create favourable habitat to the rhino.

The Department has implemented proposal (a) in which 3 rangers were stationed at a post situated at the main access point on the north-western tip of the reserve. They were provided with living quarters and were required to patrol the reserve regularly. Proposal (b) was approved but we are still waiting for the green light from the State Government. Proposal (c) was not enforced earlier as the Department felt that important wildlife areas such as

reserves and sanctuaries should not be disturbed unless results obtained from limited experiments proved beneficial to the rhinos. With the availability of expertise, fund and manpower the Department is now able to carry out some modification to the rhino habitat in Sg. Dusun Reserve.

In 1974 a rhino project was started by the Department with the initial objective of obtaining a more accurate information on the ecology of the rhino, its distribution, habitat use and their status throughout Peninsular Malaysia. Rhino Research Units were formed at areas considered viable such as Segamat for Endau-Rompin, at Kuala Tahan for Taman Negara, Pahang and Sg. Dusun, Selangor to monitor these populations and to carry out regular patrols.

It was later decided that an intensive study should be made in this area with the prime objective of developing a management plan. In 1979, after five years intensive research, a plan was formulated for Endau-Rompin. Although the research was done in less than a year and the results obtained not as detailed as the Endau-Rompin report, the author believes that the informations

## 2. STUDY AREA DESCRIPTION

### 2.1 Geographical description:- (please refer to map 1)

The Sg. Dusun Game Reserve has an area of about 10,700 acres or about 4280 hactres approx. 50 sq. km). It lies between 3° 35' to 3° 40' north of latitude and 101° 23' to 101° 27' east of longitude. The reserve is roughly about 120 km north west of Kuala Lumpur. It could be approached from three different directions:-

- a. East of the reserve from Tg. Malim.
- b. East of the reserve from Slim River via Lima Belas Estate.
- c. West of the reserve from the coastal town of Sg. Besar.

A metalled road that connects Tg. Malim to Sg. Besar is just about 1 km north of the reserve and from this road a logging track leads to the ranger's post at the north-western tip of the reserve. In short, the reserve is easily accessible.

The reserve is drained by a two-river system namely the bigger Sg. Bernam in the north and Sg. Tengi in the south and both flows to the Straits of Malacca to the west. Sg. Bernam is the geographical boundary between Selangor and Perak State. Sg. Dusun a tributary of this river drains the northern part of the reserve. A canal connecting, Sg. Bernam and Sg. Tengi runs parallel to the reserve's boundary on the western side. It was dug in 1962 to help increase the volume of water in the lower irrigated areas.

The reserve is bordered by an extensive area of peat forest on the western and southern sides and two land schemes on the northern and eastern sides. Further east is a forest reserve, the Bukit Belata Forest Reserve which joined the Game Reserve on the southern side. The reserve is roughly in the shape of the South American continent. If an imaginary line is drawn dividing the reserve into two equal halves, the bottom half will consist of low lying areas with peats of more than 2 m. deep and covered with vegetation which has a very thick undergrowth. This makes tracking difficult. Whereas in the upper half the land is comparatively higher and drier with gentle hills. On the north-east side of the reserve a range runs in the north-west to south-east direction, the highest peak being 829 feet (252 metre).

## 2.2 Flora

The vegetation of this region is essentially Tropical Rain Forest of peat swamp influence, the only difference lies with those at higher and drier land. In the northern half of the reserve the forest is of the secondary type as the area was logged before the area was turned into a game reserve. The southern half which consists of peat-swamp forest is still untouched.

The vegetation of the peat forest is specifically adapted to the poorly drained and soft peat. Most of the dominant species like Kempas (*Compassia malaccensis*) has well developed buttress to anchor its weight. Also conspicuous are climbing palms such as rattan and lianas. Species such as Pandans and Mengkuang are found in abundance near river banks. The size of dominant trees are comparatively smaller than those of drier land and this consists of species like Kempas, Nyatoh, Pulai, Resak and Merawan. Several species of Meranti and Kuruing (Dipterocarpaceae) such as Meranti Paya, Meranti Bakau and Meranti Bunga which adapt to the swamp condition were Keruing found in abundance. The understory consists of sapling of dominant species and several shade tolerant species. The drier land has more or less the same structure but the lower storey and undergrowth is dominated by Bertam (*Euguisonia triste*). The forest ground is thickly littered.

## 2.3 Fauna

A recent study (Siti Hawa, 83) of the fauna of this reserve shows that it contains at least 20 families of wildlife. The most abundant of large mammal species are Wild pigs *Sus scrofa* of the family Suidae. Other common ground mammals are *Trigulidae* (smaller mousedeer), Cervidae (Sambar deer) while several species of primates could be found such as *Hylobates lar* (ungka) *Presbytis malalophos* (ceneka), *P. obscura* (Lotong cengkong), *P. cristata* (Lotong Kelabu) and of course *Macaca fascicularis* (kera) and *Macaca nemestrina* (berok). 24 families of birds were recorded during the 3 months study among which are Bulbuls, Doves and Pigeons, Sunbirds and Magpies. Several rhinoceros hornbills and grackles could also be observed along the canal. And of course the most important and rarest are the Sumatran rhinos which have been using the reserve since prehistorical times.

## 2.4 Climate

This is the most important factor that not only influences the vegetation and environment but could also effects; research programmes. Two distinct seasons namely the dry and wet seasons or the west-coastal influence are experienced here. During the wet season which occur between the months of August and February the swamp will be full of water and most areas near the river will be flooded. Generally speaking research work is confined to dry season when tracking is easier and tracks found could be measured.

## 3. THE SPECIES

### 3.1 Species description

The Sumatran rhinoceros (*Dicerorhinus sumatrensis* FISCHER 1814) is considered the most primitive of all living rhinos. It was believed to have migrated from Western Europe 40 million years ago. Another unique feature is that it is also the smallest and the only rhino with an extensive body hair. Adults stand at 1.2 to 1.4 metres at shoulder level and measured 2.2 to 2.8 metres from muzzle to root of tail. The coat is usually of darker shade.

### 3.2 Species Identification

There are four distinct features usually used to differentiate this species from other Asiatic rhinos:

- a) body coated with extensive hair
- b) comparatively small in stature
- c) presence of two horns on the nose, the posterior horn less developed than the anterior horn.
- d) has marked skin-folds only on the front half of the body.

### 3.3 Taxonomic classification

Class - Mammalia

Order - Perrissodactyla

Family - Rhinocerotidae

Genus - *Dicerorhinus*

Species - *D. Sumatrensis*

Sub-species - *Dicerorhinus sumatrensis-sumatrensis* FISCHER 1814

### 3.4 Possibility of mixed-up species?

There are records of the previous existence of Javan rhino (*Rhinoceros sondaicus*) in this area and the last individual was believed to have been shot for the British Museum in 1932. This species is much bigger than the Sumatran rhino with adult height of about 2 metres and tracks more than 20



cm. During the study no such measurements were encountered and it was concluded that this species is no longer in existence here. Based on two photographs that were taken of the rhinos from this area (one taken in Lima Belas Estate in 1957 and the other by one of the rangers at the post recently) and description from encounters confirmed that only the Sumatran rhinos exist here.

#### **4. METHODOLOGY**

##### **4.1 Determining approximate total home range**

This is the first part of the project. Before a survey is carried out the extent of the home-range should be determined so that survey-routes designed will encompass the total range and thus providing a more reliable estimate of the population. The range of each animal as done by Strickland was determined from results obtained by following it. However after several attempts to follow an individual and to plot its range it was concluded that it was nearly impossible to do so due to several reasons the major one being the difficulty of identifying an individual based on tracks. This is so because variation in sizes of tracks occurs due to the different hardness of ground and also due to various types of locomotion i.e. walking, running and climbing. As the adult rhinos have track measurements with small range i.e. between 18.0 cm to 20.0 cm and the above variation also within the same range i.e. 2 cm (Rodney, Tajudin, 82), this factor can cause confusion and ultimately range plotted could be misleading. To avoid this it was decided not to follow this technique.

In order to determine the total ranges of the population, information from several sources had to be obtained. That included a) checking past records and maps, cross-checking facts in Strickland's report with rangers who have had worked with him, b) interviewing people who have seen the rhino to get details of description and location, and c) making extensive trips to areas that was probably part of the rhino's range to get a first-hand information and also to check claims.

The method proved useful as during the course of study, the areas visited by the rhinos and their extent of movement was identified. However this is still an approximate total range, meaning areas that could probably be visited by the rhino. Actual range could only be determined by continuous trekking and by using radiotelemetry over a long period of time as a rhino might spend most of its time in an area known as core area but suddenly abandon the usual pattern of movement and wander into other areas but never failing to return to the original area. It was unfortunate that Strickland did not encounter this movement as it was not mentioned in his report.

##### **4.2 Determining status of population**

Status simply means the condition of the population i.e. their size, structure, viability and other parameters that could describe the situation of the population. To determine status it is necessary to check past records, trekking and most important to carry out survey of the population.

A survey was carried out using the method devised by Schenkel/Hullinger in which survey-routes were plotted to traverse areas that were considered to have a high density of rhinos. Usually, the routes follow river systems as it is known that rhinos prefer to travel along rivers and the tracks made are easier to measure. This area also contained numerous logging trails and it is known that rhinos like to travel along the trail, thus teams were also assigned to follow these trails. Each team was assigned specific routes that covered certain areas and the survey began at the same time. When tracks were encountered only the hindfoot print were measured, their age was approximately determined and other relevant data were recorded such as the position, topography, date and habitat. When the survey was completed, the results are collected and analysed. Three important factors were considered when identifying an individual namely size of tracks, age of tracks and their distance apart. For example a track of similar size and age but of distance is not possible to be made by the same rhino in a day and would be considered as made by a separate individual. It must be mentioned that rhino's movement in swamp forest is much slower due to soft ground and poor accessibility. As mentioned earlier hardness of ground and type of locomotion do affect the dimension of tracks, therefore in analysing the size these factors need to be considered as well.

In order to determine the viability of a population the sign that is important is evidence of reproduction i.e. recruitment of young into the population. It was believed that a calf will follow the cow for about 6 years before it became independent (Hubback, 1939). Therefore during tracking if a large print followed by a smaller print were regularly encountered it shows that a young must have been born. It must be stressed that the rhino is a solitary animal and it is rather unusual to find a pair in the wild except during courtship and mating and also in a situation described above.

However other parameters regarding the individuals such as sex, age and other details could only be defined by visual observation. Those who had seen the rhino have usually been too terrified to note the important details. Usually the sightings were brief. A few times last year the rhino came to the post very early in the morning i.e. after midnight and therefore it was difficult to observe. If the Department could provide a camera equipped with a good flash then in the near future a good collection of rhino pictures could be obtained as the rhino never fail to visit the post. This could greatly help in determining the above parameter.

## 5. RESULTS ON HOME RANGE

### 5.1 Definition

Home range is essentially an area covered by the animal and the size of a range is usually dependant on the distance of movement of the animal in its quest to obtain basic necessities such as food, water and cover. Various other factors such as behaviour, size, sex and species of animal also have an influence but not as distinctive as the above factors. For herbivores usually a series of saltlicks are present within it's range as it is known minerals such

as calcium, phosphorus, magnesium have a profound influence on the performance of organs. For the rhinoceros usually the range also will include a series of wallows and rivers as it is known that the rhino has a poor thermoregulatory system and thus needs mud or occasional swim to maintain the body temperature. Rhinos are believed to be territorial animals and will jealously guard their range. A complex system of scent traces marked their range's boundary. Fights usually occur between adult species because of intrusion and sometimes in obtaining territorial control. Dominant bull has a range that encompasses the population and enjoy mating rights. Ranges usually overlap at areas such as preferable feeding ground and common wallows. Population density is usually dictated by the species intrinsic behavioural factors (Schenkel, 1979) and a study at Endau Rompin revealed density of 1 animal per 40 sq. km - higher density than other rhino species.

## 5.2 Limiting factors

The extent of the range is also dependant on obstacles present either man-made or natural. Usually forest-dwellers will restrict themselves to the forested areas and once the forest is cleared the extent of movement is limited to the boundaries created by this development. A herd of elephants might venture into plantations but would be forced to stay out once electric-fences are installed. Human development certainly affect the range and the animal has to modify it's range to suit this interference. Natural obstacles such as wide rivers and high mountain ranges do affect the range of certain wildlife that has not the prowess to swim across or scale the steep slope. Although man-made obstacles do affect the range of rhino natural obstacles do not. This species of rhino is known to have great endurance and could negotiate steep slopes and swim across swift rivers. It was observed in Burma that it even swam across the sea to offshore island (Evan, 1905). In Sg. Dusun the rhino frequently crossed the canal and the bigger Bernam river.

## 5.3 Characteristic and range

Most researchers agreed to the fact that this rhino species is rather conservative i.e. it uses the same saltlicks, wallow, feeding areas and the main tracks may be used over generations. Main tracks are well worn and the animal seldom deviate from them (Strickland, 1967). The main trail connects and cover all feeding areas, wallow, bedding sites and saltlicks. A study on the Indian rhinos revealed that on average they spend about 45% of their time feeding, 30% resting and 25% on other activities. Feeding is popular at night time while the morning till noon will be spent resting. (Martin, 1982).

Many researchers agreed that there are two types of movements; the normal, regular movement within an internal range and another movement typical of this animal but irregular referred to as 'wandering' (Ansell, 1947) (U Tun Yin, 1954) (Metcalf, 1961) and (Kurt, 1970). The usual internal travel include distances covered from bedding sites to pastures, movement within

pastures while feeding and movement from one pasture site to another, movement from the pastures to resting place or to drinking areas. Wandering is a movement away from the traditional internal area and the travel involved great distances and takes quite some time. A factor or several factors that caused this wandering is still a mystery. Some attribute this to searching for preferable food (Metcalf, 1961) while others believed it was the weather as it was observed that rhino would stay in the mountains of Burma in the hot season and tour the lowland during the rainy season (Evans, 1905). Other reasons that could be given include a decrease in the carrying capacity of the habitat, loss due to fighting for mating rights or just a traditionally transferred behaviour among the rhinos. This is an area that needs further research to pinpoint the cause of such behaviour. It is necessary to gather all the information on the factors governing the behaviour so that the actual home range can be worked out. It can only be done through a higher level research using sophisticated equipments.

Another mystery concerning the wandering is the ability of the rhino to return to its traditional range after spending a long time and a great distance away from the usual range where scent marks would have disappeared. The animal must have a very strong sense of smell to be able to pick-up scent marks left the year before. It was believed that rhinos would urinate in the wallows and as a result their body will be covered with the smell and this is used to mark trails. Trails were also marked by secretion from foot gland. In addition some rhinos would scatter their dung to mark off trails. Tracking depends mainly on visual contact which is quite limited. Trained tracker dog is not a bad idea to use for tracking to pick-up the scent traces.

With respect to locomotion there is a distinct difference in the pattern of movement during this wandering. The animal was tracked several times during it's wandering to the south of the reserve and it was discovered that the pattern of movement was quite straight. The rhino apparently moved without stopping for food or resting for several miles. It was different from the pattern during feeding in the reserve which was in the form of loops criss-crossing the main trail. Once it finds a preferable area it would stay for a few months for feeding and resting. Then it would move again usually following a river either upstream or downstream. This was assumed to be the way a rhino finds its direction during its wandering.

#### 5.4 Approximate home range

The priority of the study was to determine areas utilised by the rhinos particularly those outside the reserve. During the course of study extensive areas that were suspected to have been visited by the rhino population were covered. That was based on reports, informations as describe in the chapter on 'Methodology'. Relying on signs to confirm the presence of animals is undoubtedly a difficult task as fresh signs could easily be wiped out after a heavy downpour. Most information given were checked but in many cases no signs were found to back the claims. It must be realized that it was very difficult to determine outer ranges. Unlike ranges within the core area

where it was easy to find fresh evidence and the probability of the presence of rhinos was high, the opposite was true of the outer ranges. Therefore only reliable information given was considered. In addition, reports that were confirmed irrespective of time (such as a rhino was photographed at Lima Blas Estate in 1957) were accounted to determine the approximate total range of the population. It was assumed that the place where the rhinos were seen was part of its home range.

A. The North/West (Please refer to Map III A)

**Northern**

This area consist of an extensive peat swamp to the West, comprising of Changkat Menteri, Sg. Sepong and its tributaries Sg. Chawang and Sg. Erong, Felda Besaot schemes, Sg. Dharoi basin, Lima Blas Estate, Felda Gedangsa and Felda Sg. Dusun. The major river system here is the Sg. Bernam.

During the time when Strickland did his study (1966) there was still a vast forested area between Sg. Sepong and Lima Blas Estate. There was a series of established saltlicks at the point where Sg. Sepong splits into Sg. Chawang and Sg. Erong and undoubtedly rhinos used to visit these saltlicks (Aborigines at Ct Kereta, pers com). At about the same time rhino tracks were observed on the banks of Sg. Bernam and at Changkat Menteri (Mohd. Khan, per com) but unfortunately Strickland did not mention this. During the seventies the area was extensively developed for Felda Besaot schemes. Recently Ladang Ulu Bernam expended its estate eastward up to Ct Menteri on the South and its northern boundary almost met the western boundary of Felda Besaot 4. This directly prevented the rhinos from moving to the saltlicks. The saltlick was checked during the course of study but no rhino signs were found. A rhino was reported to have been seen between the aborigines settlement at Ct Kereta and Felda Besaot 3 but no signs were encountered to confirm the report. The probability of rhinos around this areas was low due to the above fact but in future occasional visit should be made around the saltlicks to check whether any rhino was stranded at Chawang river basin due to this development. The plantations were bordered by electric fences to avoid elephants from damaging the crops and that directly prevented the rhinos from moving further north and vice versa. Therefore in future if there is any positive indication that a rhino is found at the saltlick, rescue operation should be started so that the stranded rhino can be reintroduced to its main population at Sg. Dusun.

Between Felda Besaot 4 and Lima Blas Estate there are two small scale private plantations namely Dinding Sugar Industries and Ladang 100 Ekar and that prevented the rhinos from moving further up Sg. Daharoi. A rhino was seen and photographed at Lima Blas Estate in 1947. Apparently it still visits this area and as recently as January 24th. 1983 a rhino was seen at Felda Gedangsa which is neighbouring Lima Blas Estate and the track measured 17.3 - 18.6 cm. It was assumed that the rhino came from the reserve, where it followed Sg. Bernam upstream and turned left where it was seen by a tapper.

## Western

On the western side the movement is limited to areas adjacent to the reserve. Although the forest was under peat swamp influence it is rich in commercial species and therefore it is not surprising to see several kongsis (Logging quarters) on both sides of the road from the ranger's post to Sg. Besar. The common method of hauling logs is by using railtracks but mechanized haulers are also used. Most of these trails and signs were checked and were found only north of the road. Loggers interviewed agreed to this fact as according to them the peat is deeper south of the road and most of the time these areas are under water and therefore unsuitable to wildlife whereas north of the road the areas are drained by the Sg. Dusun. During the recent survey, tracks of two different individuals were found along trails north of the road.

A rhino was reported to have been seen near the Youth schemes adjacent to Ct Menteri a few years ago. Therefore the extent of range on the western area includes areas north of the road to Sg. Besar and to Sg. Bernam including Sg. Dusun basin. A metalled road was built recently which passes through this area and on the north of the reserve where it breaks the continuity of the forested area. It did not prove to be a hinderance to the movement of the population as the animals could easily cross the road. However the only danger is the recklessly driven timber lorries which use this road daily.

## Summation of finding with respect to northern and western areas

Much of the movement of the rhinos in this area is in the Sg. Bernam basin because of plentiful food lush vegetation on both sides of the banks, adequate cover and abundant water for drinking and for cooling. Abundant crossing marks on both sides of the banks either upstream (i.e. until it was seen at Lima Blas Estate on Felda Gedangsa) or downstream (where it was found at Ct. Menteri or near the Youth scheme). The heavily used ones are those in between the DID headworks to the point where Sg. Dusun joins Sg. Bernam. Therefore if the Department decided to request for additional land it should include the area mentioned above.

Eastern and Southern (Please refer Map III B)

## Eastern

The movement of the rhino to the eastern region is restricted by two land schemes which are relatively large namely Felda Sg. Dusun (Felda Soeharto) and Felda Sg. Tenggi. Rhino was frequently observed wandering near the border but not any further as the plantation lacked food preferred by the rhinos.

## Southern

The western part of this southern area is covered by an extensive peat swamp forest, a continuation of the peat forest described earlier. The rhino,

as any land mammal, would avoid this as their movement is severely hindered by deep peat and thick undergrowth. Even the southern half of the reserve was not used by the rhino due to a similar reason. These southern areas are made up of several continuous forest reserves namely Bukit Belata Forest, Bukit Tarik Forest Reserve, Bt. Tunggul Forest Reserve and Rantau Panjang Forest Reserve. Except for Bukit Tunggul Forest Reserve which is described above as peat forest the rest of the forest reserves are comparatively higher and drier. They form part of Selangor river basin.

The movement of rhino to these areas came to light only recently. Earlier there were no reports of rhino utilising this area. On July 29th. 1982, a rhino was reported to be seen at Ulu Selangor Estate near Kuala Kubu Bharu, a linear distance of about 40 - 60 km from the reserve. It was investigated and confirmed that there was indeed a rhino of measurement 18.5 - 19.5 cm. During the course of investigation it was found out that the rhino was earlier seen by hunters at a secondary jungle 15 km south-west of the estate. Field checking revealed that apparently the rhino had been using that place for quite sometime, may be from late 1981 to early 1982. The assumption made was that the rhino followed Sg. Buloh downstream and at the point where Sg. Buloh joined Sg. Selangor it turned eastward and stayed at the secondary jungle for a few months. Then it moved northward following Sg. Kerling upstream but later followed Sg. Beruang to Ulu Selangor Estate. During the recent rhino survey it's tracks were found at Sg. Buloh in a direction towards the reserve and that indicated that it was on a return journey.

#### **Summation of finding with respect to southern and eastern area**

The movement to the south is strictly a wandering due to its irregularity. The movement in general rely on the Selangor river system. The movement to the South was undetected as it followed the continuous forest reserve mentioned above which is connected to the reserve on the South. This area, especially Sg. Buloh needs to be regularly checked to detect any similar movements in the future.

#### **5.5 Overall home range and core area (Please refer Map IV)**

As mentioned earlier the movement of the population were in two distinct patterns, the movement within traditional core area and the other movement referred as 'wandering'. Based on the above findings approximate area of this core area and the area used during wandering were plotted.

The core area consist of the area between Sg. Bernam (from south of Sg. Dusun to DID Headworkds) to the northern half of the reserve and the area in between this. The area used by the wandering behaviour shows a general north-west to south-east direction as this pattern essentially followed forested areas and once the forest is cleared for land schemes undoubtedly the pattern will change. It was learnt from reliable sources that Felda Sg. Tengi will be extended southwards and this would, in the future, restrict the movement of rhinos to the south.

6. RESULT ON THE STATUS OF POPULATION

6.1 Rhino survey:-

A survey was undertaken in Sg. Dusun Game Reserve and areas surrounding it from the 10th to 13th May, 1983 following the method described previously. It involved 19 personnels (appendix 1) who were divided into five teams. Each team was assigned specific routes to follow which was defined earlier and were believed to cover areas that contain rhino (please refer Map IV). Data recording sheets were provided to team leaders which were used in recording track measurements and other relevant data (appendix I).

6.2 Result

Results obtained were tabulated as below:-

Observation	team	position/ place	time/ date	approximate age	mean measurement	soil	Personal Opinion
1.	A	215600 (Hind 1035 sheet 3B/6) Forest fringes north of Ranger's post	12.00 pm 10.5.83	more than one week (more than 3/5/83)	17.25 cm	hard	Animal (1)
2.	A	081445 (Series L 7010) 3 km North of post	12.30 pm 10.5.83	less than a week (3-4 days) ( 6/5/83)	17.8 cm	medium	Animal (1)
3.	A	086445 (Series L 7010) 5 km North of post	3.00 pm 10.5.83	recent 1-2 days ( 8/5/83)	18.0 cm	soft	Animal (1)
4.	A	079439 (Series L 7010) 5 km south east of post	9.45 am 11.5.83	recent may be over night (10/5/83)	18.69 cm	hard	Animal (1)
5.	A	220600 (Series Hind 1035 sheet 3B/6) 3 km east of post	12.00 pm 11.5.83	about 2 days (9/5/83)	18.30 cm	hard	Animal (2)



Observation	team	position/ place	time/ date	approximate age	mean measurement	soil	Personal Opinion
6.	A	19 \$12 (Series Hind 1035 sheet 3B/6 North West of post	12.30 pm 12.5.83	recent, may be over night (11/5/83)	18.26 cm	hard	Animal (3)
7.	A	175595 (Series Hind 1035) 8 km West of post	10.30 am 13.5.83	about 2 days (11/5/83)	19.0 cm	soft	Animal (4)
8.	E	263300 (L 7010 series) Sg. Buloh	2.45 13.5.83	1-2 weeks (more than 6/5/83)	19.25 cm	soft	Animal (5)

### 6.3 Analysis

From the table it can be deduced that the approximate total population of rhinos based on measurements taken during the survey was five animals. They are:

- a) a cow and a calf pair found in the reserve. The calf measurements are as readings in observation 1, 2 and 3 while the cow measurements are as in observation 4 and 5. Reading 1 and reading 4 are taken on the same ground condition (hard) reflected, the accurate size of track; the cow 18.3 - 18.7 cm while calf's between 17.25 to 18.0 cm. The pair was seen a few years ago near the ranger's post but during the survey the calf was found on the northern side of the post while the cow on the southern side and this indicated that a semi-independent relationship has developed.
- b) two adults as reflected in measurements 6 and 7. Although the measurements are almost similar (reading 6 with measurement 18.26 cm measured on hard ground and reading 7 with measurement 19.0 cm measured on hard ground) the 1 cm difference indicated separate individuals as the age of the track is the same i.e. made on 11/5/83 and the distance between them quite apart, about 5 km. In order to confirm that, further checking was done after the survey. Although the position has moved their movement is still restricted to around that place. It must be mentioned that movement of animal in swamp area is severely reduced by soggy ground and thick undergrowth.

- c) the largest measurement of 19.25 cm as in reading 8 is believed to belong to the animal that were tracked much further south last year and looking at the direction it seems that it is on the way back to the reserve.

#### 6.4 Discussion

It is unfortunate that 3 teams did not contribute to the readings discussed earlier. Team B found a set of tracks but could not measure them as it was obliterated by weather. If measureable, this could provide a case for counting another individual. Team C which was assigned to traverse along Bernam river reported that the water level was quite high at the time and therefore any crossing marks made by the rhino was difficult to detect. Team D reported that logging is taking place South of Besout 4 and also at Ct Menteri while most places are flooded. Therefore as a suggestion the next survey should be carried out during the dry season, preferably in the month of March or April.

From the map it can be seen that four animals were found within the area between the reserve and Sg. Bernam an area defined as core-area. Only one individual was found outside this core area, that is at Sg. Buloh, South of Bukit Belata Forest Reserve.

Total area covered was around 200 - 300 sq. km and therefore the overall density was one animal per 40 - 60 sq. km which is about the same as those in Endau-Rompin. The density within the reserve is one animal per 25 sq. km but if we were going to account the fact that only the northern portion of the reserve is utilized, then the density is much higher i.e. one animal per 10 - 15 sq. km. Assuming that the tracks encountered represented about half the rhino population then the number of rhinos around this area should double those estimated. However previous estimates (i.e. Strickland 3 - 5 animals and Rodney/Tajuddin 4 - 6 animals) indicated a general agreement that the rhino population at Sg. Dusun and areas surrounding it is between 3 - 6 animals. Our estimate based on the survey that the population of 5 individuals is within that range. A more accurate status could only be obtained by taking the average figure of surveys in the coming years.

#### 6.5 Conclusion

From the above it can be concluded that the status of rhino population at Sg. Dusun has increased compared to previous estimates and this could be attributed to recruitment of young into the population throughout the years. A pair that was observed in the reserve recently indicated the presence of a reproductive cow and it shows that this is certainly not a residual or relic population. Strickland in his report mentioned an animal of measurement 21 - 23 cm but no signs of this animal was encountered during the survey. Regular reports from the rangers too did not indicate the presence of this animal for a long

time. Therefore it was concluded that the missing animal is either untraced or simply has died years ago. Nevertheless, though small, this population is viable. It can increase in future years if adequate protection and an environment conducive for reproduction is maintained. Ideally the core area should be within the reserve and it is hoped that the request to expand the reserve on the adjacent western direction materialised in the near future.

## **7. PROJECT TO INCREASE FOOD SUPPLY**

### **7.1 Introduction**

Bertam (*Eugeissona tristis*) is a big clump-forming palms with short underground closely branching rhizome and producing terminally flowering rosettes. It is found throughout dry land forests in the lowlands and to about 2500' asl. Usually it prospers along the ridges but in other areas too it commonly dominates the understorey to the exclusion of other plants. As these plants are a source of food supply this seriously affect the herbivores. It is unusual amongst undergrowth palms in that it can survive opening of the tree canopy. Bertam is not consumed by any animal and because of its colonizing effect it is considered a weed species.

In Sg. Dusun Game Reserve Bertam dominates the understorey of the drier lands particularly those northern half of the reserve. This area is also heavily used by the rhinos and the presence of extensive clumps of Bertam directly affect the growth of regenerations which forms a major percentage of rhino's food supply. Eliminating Bertam is a possible solution to increase these suppressed regenerations and to encourage the growth of seedlings. Providing more food will directly increase the carrying capacity of the reserve thus avoiding a situation whereby it could be a limiting factor for population growth in the future.

### **7.2 Pilot experiment**

Bertam eradication or control was started in the early nineteenth century by the Forest Department of Malaya but serious effort which produced good result began after phytocides was introduced in 1950s (J. Whytt Smith). Until now most experiments involve using chemicals such as Kenapon, Dalapon and the common Sodium Arsenic which is poisonous. As these chemicals are harmful to wildlife it could not be used to poison Bertam in the game reserve. The only method feasible is the manual cutting and slashing and that was adopted in the pilot experiment. The plan was earlier discussed and duly approved by the Director General.

The area chosen was along the trail north of the ranger's post. Any Bertam found on the fringe of the forest to a distance of 1 km away

was cut and slashed. The extent of the clearance was 20' on either side of the trail. The project was carried out by them about a month rangers and it took.

### 7.3 Result

It was observed that after one month the Bertam fronds completely rot and the regenerations started to attain vigour. During the first three months rhinos avoid the area but began visiting it frequently after that in search of food. Feeding traces was observed at certain areas along the trail. However after six months the Bertam started to grow again from the previously slashed clumps. From the Forest Department's record it was recommended that two ground-level cuttings of Bertam with two year interval in between followed by a third cutting four years later is sufficient to enable regenerations to get away (J. Wyatt Smith). In this case after the first cutting, the second cutting is recommended after six months as it was evident that regrowth appeared at that time.

### 7.4 Comments

There were several difficulties with regards to the cutting. In the reserve the majority of the clumps were big with diameter of more than 3 feet across and most of the time the cutting is limited to the fronds only. It is hard to chop the clumps to ground level with a parang. Perhaps with proper equipment this could be done.

Secondly some of the fronds that were cut fell onto the regenerations around the clump and did some damage. That was because the stalks of the fronds had sharp slender spines which were difficult to handle. This problem can be solved by using gloves.

Thirdly the fronds that was cut should be gathered and put at places which has less regenerations and not haphazardly left to cover regenerations. This will increase the percentage of survival.

### 7.5 Proposal

Because of a long period of dominance by Bertam most of the undergrowth lacks regeneration. It is proposed that planting of species preferred by the rhinos which was identified by earlier researchers be done. For a start Macangga species like Mahang and Kubin which have fast growth rates and have the tendency to be gregarious should be selected. Nursery could be built behind the ranger's post. This proposal should be further discussed with the experts at the Forest Research Institute, Kepong. They could provide expertise to train the rangers.

From the result it was observed that this temporary disturbances did not affect the rhino as feeding commenced after the Bertam was cut

Therefore it is suggested that all the Bertam along the trail should be eradicated and planted with species preferred by rhinos.

## 7.6 Prospect

If this project is successful the amount of preferable food will increase and this will attract more rhinos to the reserve. Closer association will increase the chances of mating and the possibilities of an increase in population.

## 8. CONSERVATION

### 8.1 Background

One of the objectives of conservation is to ensure the survival of rare species especially the endangered ones. Endangered as defined by the IUCN means "Taxa in danger of extinction and whose survival is unlikely if causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that are possibly already extinct". In the Red Data Book, the Sumatran rhino is classified as an endangered species where it was printed on a sheet colored red, a colour symbolizing danger.

The Sumatran rhino formerly ranged over much of South-East Asia and because of overhunting in the past and logging and expanding human settlement in the recent years has critically reduced the number and habitat as well. The global population is probably in the low hundreds and areas that contained known viable population are as follows:

#### a) Indonesia (Sumatran) —

Gunung Leuser    30-40 animals  
Langat Kapi     5 animals  
Kerinci/Seblat   6 animals

Possibility of a few rhinos in Kalimantan

#### b) Malaysia —

Endau/Rompin    20-25 animals  
Taman Negara min.   15 animals (Pahang side)  
Sg. Dusun min.     5 animals  
Silabukan, Sabah min.   10 animals

#### c) A number of rhinos existed in other South East Asian countries.

This alarming situation of the survival of the Sumatran rhinos was realized decades ago and recently in the SSC meeting in Kuala Lumpur a delegate again raised the issue and urged the Commission to urgently put a serious action plan to save this species.

## 8.2 Conservation measures taken:-

### a) Legal measures

The Department has issued two legal measures to save this species. Firstly, the Sumatran rhino is a totally protected wildlife meaning it is an offence to shoot, kill or take the animal and anybody found guilty of such an offence will be fined a maximum penalty of M\$3000/- or two years imprisonment or both. Secondly, a game reserve i.e. Sg. Dusun Game Reserve was declared a protected area and trespassers are liable to be prosecuted. On the international scene, Malaysia is a member of the CITES. These actions indicated that the Government and in particular the Department of Wildlife and National Parks is anxiously concerned about the plight of this rare species.

### b) Enforcement

Laws are meant to be enforced so that the purpose of promulgating such laws are achieved. After the establishment of Sg. Dusun Game Reserve the Department set up a post on the north-west corner of the reserve and rangers stationed there were provided living quarters. Their duty was to patrol the reserve and areas around it and to send monthly report to their superiors regarding their findings.

Also the boundary of the reserve was demarcated and regularly cleared to prevent encroachment. Signboards were put at entry points to notify people of the restriction of entry to this reserve.

### c) Research programmes

Since its establishment numerous research projects have been carried out in the reserve. Amongst the projects were those done by O.B. Milton on the need of a reserve for the rhinos, D.L. Strickland on the ecology of rhinos, Dr. Clive Marsh on primates and recently an inventory on the wildlife was done by Siti Hawa. Several trips were made by the BBC TV crews to film the rhinos but unfortunately their efforts proved futile.

This reserve was visited by the Asian Rhino Specialist Group members as part of their field trip programme to have a closer look at the habitat.

d) Management programmes

Limited management programmes were carried out in the reserve. The Department is very cautious with regards to projects that may disturb the animal or its habitat. Therefore only limited experiments were done recently and this includes creating artificial wallows, clearing limited areas of Bertam (*Eugeissona triste*) to induce growth of bush and saplings which is a major food of rhinos. Several wallows were baited with salt to encourage frequent use.

8.3 Conservation measures proposed

a) Legal

Sumatran rhinos is not only rare but very precious. At current market price a kilo of gold was around US\$900/- but a kilo of rhino horn is doubled that value. So a penalty of US\$1200/- (approx. M\$3000/-) is low indeed. Therefore for a penalty to be a deterrent a higher sum need to be proposed.

With respect to the acreage of the reserve it is well acknowledged and repeatedly proven that it is insufficient to contain the population. It is suggested that fresh application be made to acquire the adjacent area, preferably those between the reserve and Sg. Bernam as this area was proven to be the heavily used area by Strickland and again backed by this study. It is suggested a high level appeal such as that by IUCN be sought in order to make this proposal effective.

b) Enforcement

Presently only three rangers are stationed at the reserve and they have to patrol a wide area that includes the total range of the rhinos. This also includes those areas from Ct Menteri to Lima Blas Estate in Perak which in a strict administrative sense is not within their patrol area. Therefore frequent patrol need to be done with the cooperation of rangers from the Perak state. Also rangers from Kuala Kubu Bharu are needed to help in patrolling areas in Selangor river basin as it is known that the rhinos do visit the area. The manpower need to be increased to make patrolling more effective.

The rangers were recently given a shot-gun to arm themselves during the patrol. This is a good move as formerly the rangers were unarmed and they have to check hunters who are usually fully armed.

c) Research

It is unfortunate that research in this area especially on the rhinos was not done continuously. For instance there was a lapse of several years since Strickland before another rhino research was done here. Therefore it is recommended that study in this area should be on a continuous basis as not only the population of rhinos need to be monitored but experiments need to be continued such as to increase food supply, planting of preferable food, creating more artificial wallows and saltlicks. The effects of logging on the rhino population also need to be studied.

The rangers at Sg. Dusun are relatively new and they need training in research works. Therefore it is one of the task of the person in-charge of rhino research here to guide these rangers.

d) Development

In terms of physical development the reserve lacks proper buildings and basic amenities such as pipe water and electricity. The buildings that were regarded as the ranger's post were constructed by the rangers themselves in the early seventies and recently the wooden buildings were repaired. Previously the rangers and their families used the water from the canal for drinking, cooking, washing and bathing but since the mill from Felda Sg. Dusun discharged their waste into the river they stopped using that water source. The Department provided gas lamps for their use. During the day it is unbearable as it is very hot as the house is zinc roofed. There are no fans, no ice from the freezer and this place is not recommended for urban people. Although the rangers were accustomed to all this, the Department still need to look into the possibilities of developing this post as it is the responsibility of the Department to look after the welfare of their staff. With proper attention, the morale of the staff will be boosted and this directly will have a positive effect on their work performance. It is recommended that new quarters be built and it should include a fully equipped research centre. If possible pipe water and electricity should also be supplied to the post. With all this investment the Department has a strong reason against any attempt to acquire the reserve for Felda schemes. They have tried and they will try again in the future.

#### 8.4 Dangers to the rhinos

Part of conservation process is identifying dangers that might inflict harm to the rhino population. During the study at Sg. Dusun several things were observed that could be regarded as dangers and these include:-



a) **Hunting**

This is the organized and licensed hunting for wild pigs which are abundant in this area. The bullet used to kill the pigs of course can hurt the rhinos too. The method used was to send trained dogs inside the forest while shooters wait at strategic places and opened fire once the wild animals came out of hiding. Two possibilities can be assumed here if they want to get a rhino. Firstly they are in actual fact hunting for a rhino and disguise as wild-pig hunting and secondly they can get the rhinos by accident. Therefore a buffer-zone is recommended and any hunting is restricted within this area.

b) **Trap/snares**

This is difficult to detect but there were previous reports that several snares were found at the reserve's boundary while the rangers were doing the annual boundary clearing. Usually the snares are meant to trap wildpigs but there is a possibility rhinos can be accidentally trapped this way. Therefore routine checks must be made of suspected areas and hunters.

c) **Logging**

Logging is everywhere outside the reserve and at least 10 kongsis can be seen at the roadside between Sg. Dusun and Sg. Besar. There is even a kongsi at the entry road to the reserve. There are several pros and cons regarding logging. On the beneficial side, logging will create secondary growth which is preferable to the rhinos. Logging trails left by the logging operations could be used to check the presence of rhinos as usually the rhinos also prefer to use these trails.

But the trails could also be used by the poachers. Logging could also disturb the rhinos and create stress and in theory this could affect mating and social interaction.

d) **Clear felling**

This was observed at Ct Menteri and Besaot Felda schemes. As a result of clearfelling for agricultural development, most animals evacuated the area for the neighbouring forest and this migration increases the population of the neighbouring area.

A higher density of animals will result in a decrease of carrying capacity of the area and thus competition for food and cover will develop. However this has not been proven but the possibility is there.

e) **Agricultural development and human settlement.**

Large scale agricultural development like Besaot Felda schemes will also bring settlers to work in the field. This will directly bring human population in closer contact with the animals. Usually Felda settlers will form RELA organization which will be supplied with shotguns by the Government. Some settlers have their own personal shot-guns. There is a high possibility that these guns would be used in illegal hunting.

Extensive agriculture involves a lot of chemical fertilizers and weed poisoning. This could pose a serious danger to rhinos.

f) Mill waste discharge

A palm oil mill was set-up at Felda Soeharto several years ago. Although the mill has a treatment plant, large quantities of waste was still discharged into the Sg. Dusun. Now the river is so polluted that oil slick covers the surface and this extend from the canal to the mill where the old Sg. Dusun existed.

The Wildlife here has lost their source of water. Another mill is planned at Felda Sg. Tengi and the waste will be discharged into Sg. Tengi. If not checked practically all the river system around the reserve will be polluted in the near future and this will have a serious effect on the wildlife there.

g) Contagious diseases

Recently several cows used the nearby area. Apparently the owner decided to leave the cows at the forest fringe and this could be a source of contagious disease such as antrax. This is serious as what had happened at Udjong Kulon could also happen here.

8.5 Could it be overcome?

**Better policing**

Illegal hunting and setting up of snares or traps can only be minimised by constant patrols and personal initiative to find information. Regular checking should be made around suspected area to look for snares.

**Better extension service**

Giving talks on conservation to settlers could produce some effect.

**Better cooperation and planning**

The Department should sought the cooperation from land development authorities such as Felda on matters such as extensive land

development which certainly has an effect on wildlife. A study should be made prior to land clearing to gather information which could help the wildlife. Herbicides should contain less poisonous chemicals and as far as possible not to be applied at the reserve's border.

#### **Better enforcement of Environmental quality Act**

The Felda authorities should try to treat their discharge as efficiently as possible as it is a shame to pollute rivers at their upper reaches such as in Sg. Dusun and Sg. Tenggi. Pollutants not only destroy the rich contents of the river but ultimately affect wildlife dependant on the river for their water supply.

#### **Better Management - application of existing knowledge**

The research data that were obtained from past research on rhino should be utilized in the management of this species.

### **8.6 Expectation**

Rhino Conservationists have a strong expectation regarding the conservation of rhinos at Sg. Dusun. This is reflected in several Asian Rhino Specialist Meetings and this concern was shared by the SSC members, too. Therefore the Department has to realize this expectation and start implementing programmes to save the rhino. Failure means a loss of a magnificent species in its natural habitat and this is the folly our descendents are least likely to forgive us.

## **ACKNOWLEDGEMENTS**

This study would not have been possible without the assistance of several people and in this column I wish to express my sincere gratitude especially to the following:-

1. Mr. Mohd Khan bin Momin Khan for giving me the opportunity to do research on this magnificent wildlife. I was fortunate to be guided by his valuable advice as he has an intimate knowledge of the area and as a keen naturalist, a wide experience on wildlife especially sumatran rhino.
2. Mr. Louis Ratnam for his valuable comments on the research plan and this paper.
3. The rangers at Sg. Dusun namely Abdul Rahman bin Mat Yunus, Hamzah Adam and Mat Nor Itam. Ayob Mustafa bin Man would be remembered most for allowing me to share his eight year experience at Sg. Dusun and also as a ready helper in the field.

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Appendix I

**BANCIAN BADAK KERBAU: SG. DUSUN/CHAWANG/BUKIT TAREK  
10 - 13HB. MEI, 1983**

Kumpulan	Ahli Kumpulan	Ketua	Tempat
A	1. Mohd. Zuber Hj. Zain 2. Abdul Rahman Md. Yunus	Mohd Zuber	Di dalam rezab termasuk kawasan balak di hadapan rezab dan kawasan sepanjang Sg. Bernam (sebelah selatan).
B	1. Dulkadir Hj. Husin 2. Md. Noor Itam 3. Abdul Jabar A. Rahman 4. Mahari Mohd. Nor 5. Marid A. Rahim 6. Shamsudin	Dulkadir	Kawasan bukit di Utara dan timur rezab dan sempadan FELDA Soeharto dan Sg. Tengi.
C	1. Khairiah Md. Shariff 2. Hamzah Adam 3. Abdullah Che Mud	Khairiah	Menyusur Sg. Bernam dari Kunci Air DID hingga ke Jeti Ulu Bernam Estate
D	1. Abdullah Ibrahim 2. Mustafa Ayob Man 3. Dari Unit Tangkapan Gajah 4. — sama —	Abdullah	Kawasan Erong/Chawang, Changkat Menteri, FELDA Besout termasuk kawasan Utara Sg. Bernam
E	1. Ahmad Abd. Rasid 2. Saidu Wahid 3. Soleh Hussein 4. Ismail Kassim	Ahmad	Kuala Kerling, Sg. Buloh Hutan Simpan Bukit Tarek Estate Kapar Baru/ Beguntong Rasa dan SKG

**Appendix II**

**SYIT REKOD DATA**

**BANCIAN BADAK KERBAU SG. DUSUN/CHAWANG/BUKIT TAREK  
10 - 13HB. MEI, 1983**

- 1. KUMPULAN :
- 2. MASA/HARIBULAN :
- 3. TEMPAT :
- 4. PANDUAN GRID PETA :
- 5. KEADAAN MUKA BUMI  
TERMASUK KETINGGIAN :
- 6. KEADAAN TANAH :
- 7. JENIS HUTAN :
- 8. AKTIVITI BINATANG :
- 9. JANGKA LAMA KESAN :

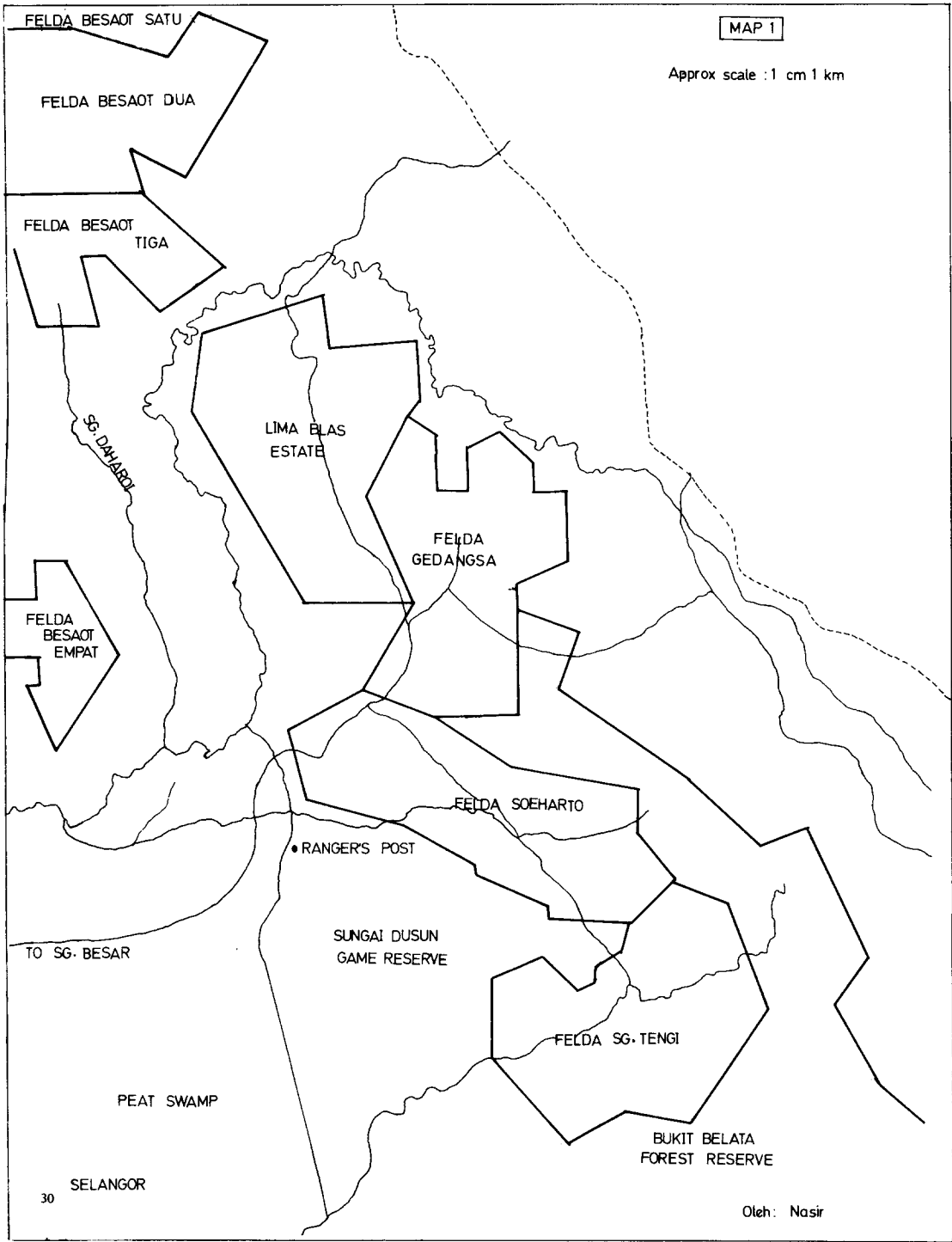
10. UKURAN KAKI BELAKANG SEBELAH KANAN (CM)		CATITAN (arah datang dan pergi makan, pohon kayu, najis etc)
KAKI	KUKU	
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

11. JIKALAU NAMPAK BADAK SILA PERHATIKAN:

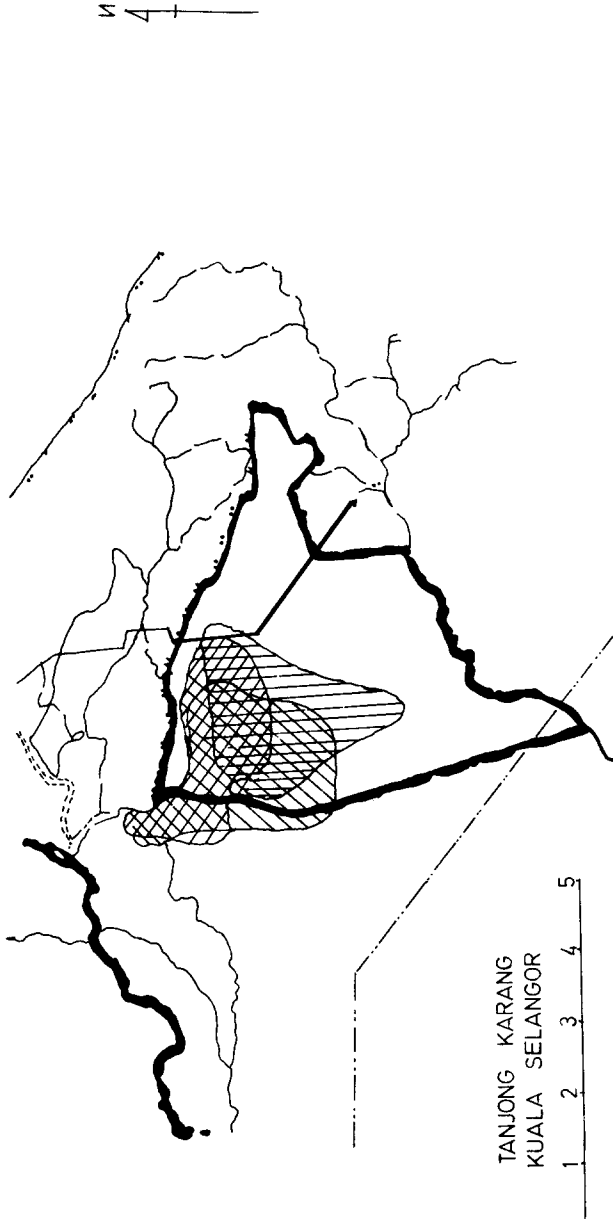
- a) JANTINA: .....
- b) PANJANG SUMBU: .....
- c) TINGGI DAN PANJANG: .....
- d) WARNA: .....
- e) LIPATAN DI BADAN: .....

12. NAMA PENCATIT DAN TANDATANGAN: .....  
.....

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Sungai Dusun Game Reserve showing the determined ranges of three rhinoceroses as follows :-

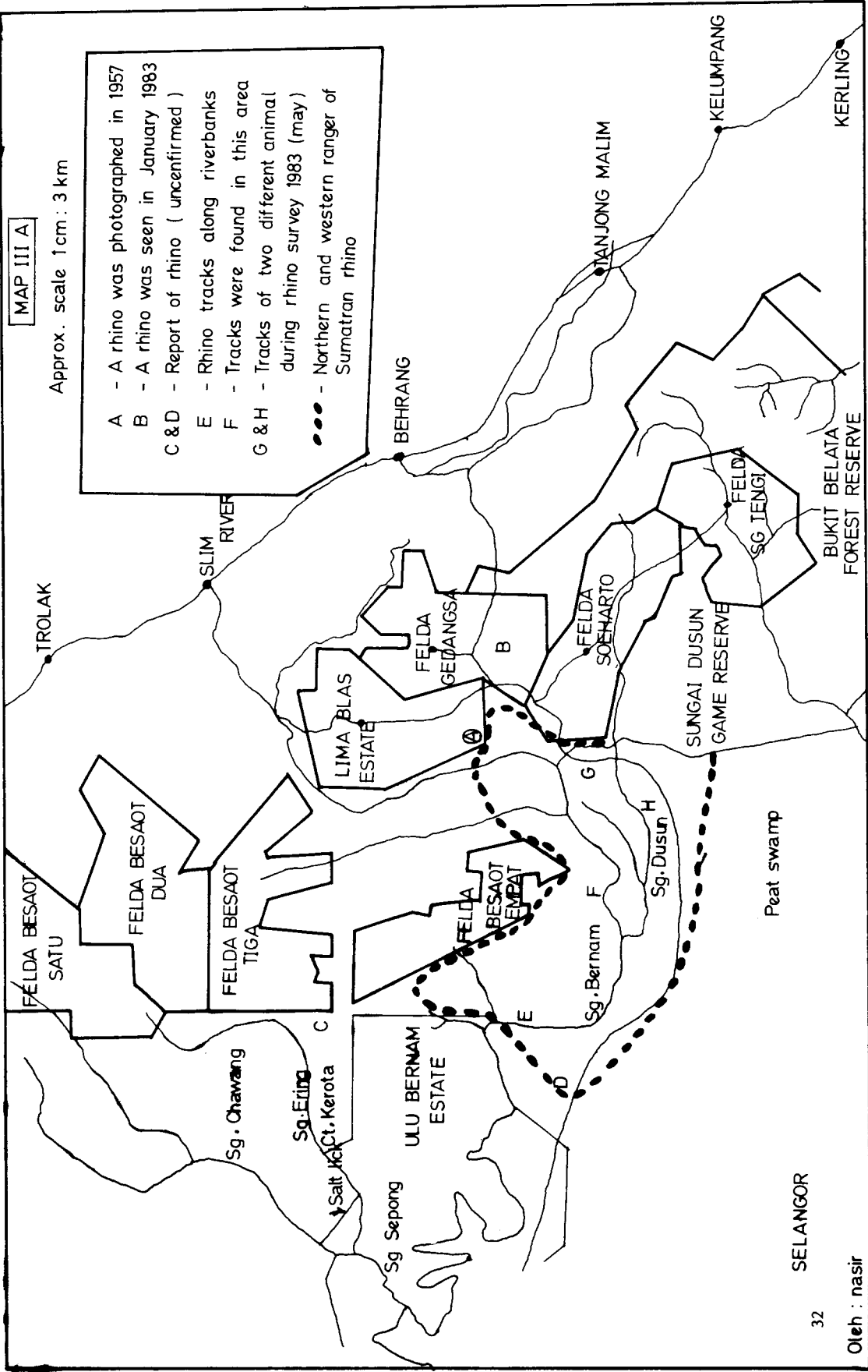
- Left - right diagonals - 17 cm foot measurement
- Right - left diagonals - 20 cm foot measurement
- Vertical lines - 22 cm foot measurement

Black dots indicate the location of major wallow areas (scale line in miles)

MAP III A

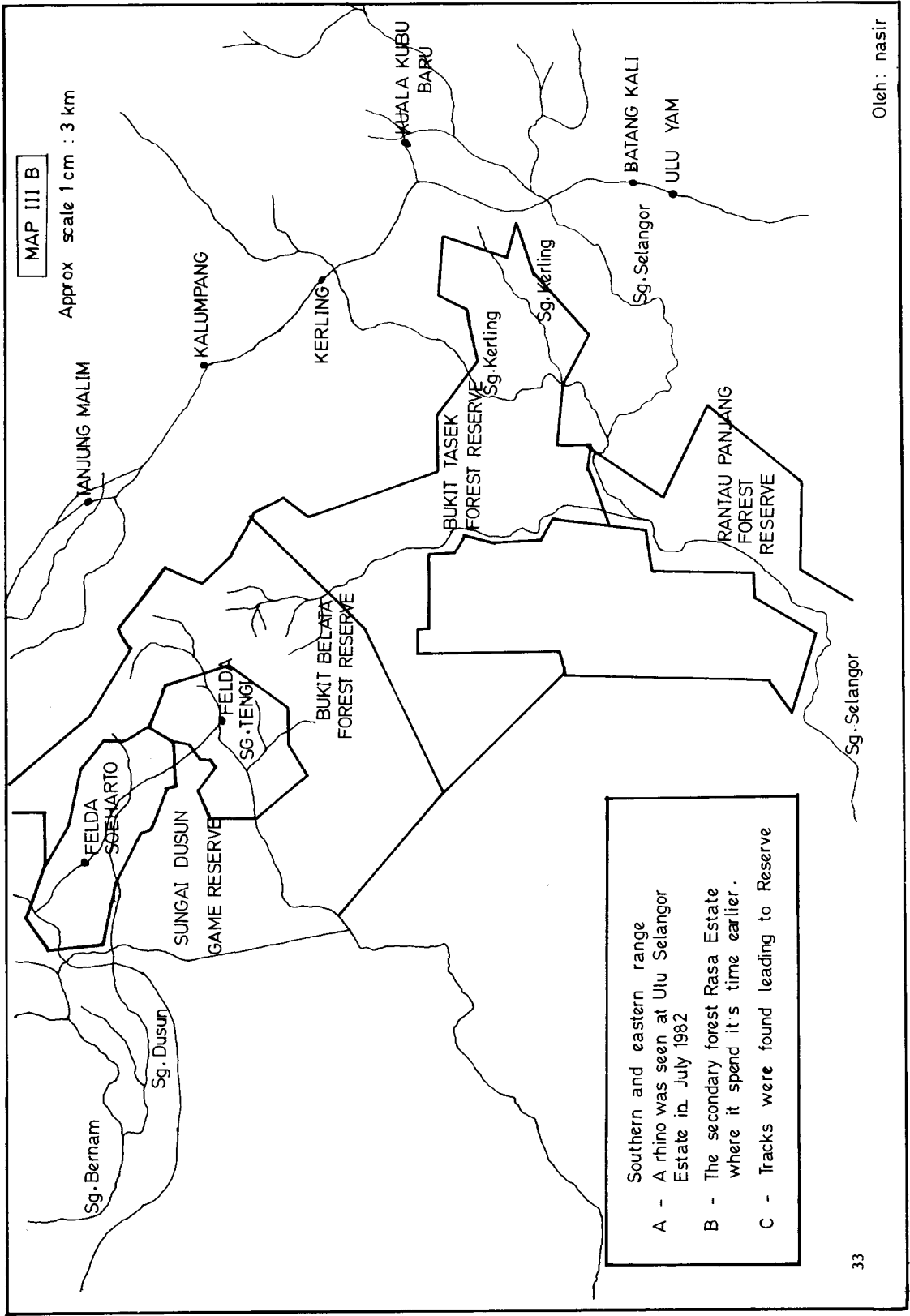
Approx. scale 1cm : 3 km

- A - A rhino was photographed in 1957
- B - A rhino was seen in January 1983
- C & D - Report of rhino ( unconfirmed )
- E - Rhino tracks along riverbanks
- F - Tracks were found in this area
- G & H - Tracks of two different animal during rhino survey 1983 ( may )
- - Northern and western ranger of Sumatran rhino



Peat swamp

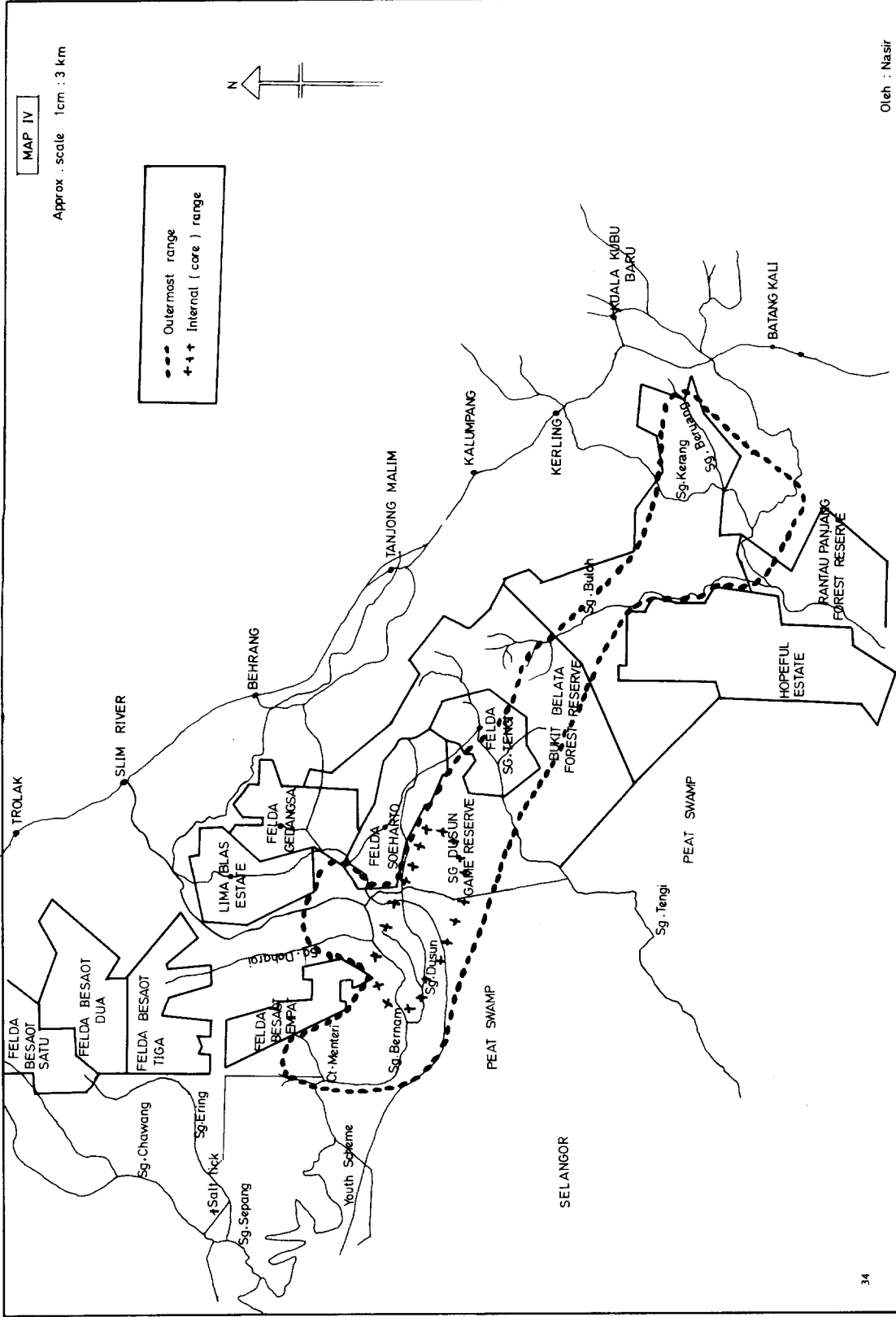
SELANGOR



MAP IV

Approx. scale 1cm : 3 km

Outermost range  
+ + +  
Internal ( core ) range



Oleh : Nasir

